The Plum Island Animal Disease Center

United States Department of Agriculture

PREPARED BY Agricultural Research Service

Northeastern Region

Prepared for the Plum Island Animal Disease Center

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COVER:

Plum Island has long been home to the osprey, or fish hawk. In the mid-1800's, these majestic birds had built over 200 nests in the trees and on the beaches of Plum Island. The constant activity on the island since then has contributed to their diminished numbers, although ospreys return annually to share the island with many other species of breeding birds.

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Contents

	Page
Research Activities	3
The Plum Island Animal Disease Center	4
Accomplishments of PIADC Scientists	6
Diagnosis and Reagent Production	8
Monoclonal Antibody Research	10
Foot-and-Mouth Disease Research	12
Genetic Engineering	14
Arthropod-Borne Viruses	16
African Swine Fever Disease Research	18
Map of Plum Island Animal Disease Center	20
Virus and Vaccine Production	22
Food and Product Evaluation	24
Training Programs	26
Foreign and Extramural Programs	28
Safety Activities	30
Engineering and Plant Management	32
Animal Supply Operations	34
Support Activities	36
PIADC History	38
Packaging Infectious Biologicals	40
Index	41

Research Activities

Diagnosis and Reagent Production
A.H. Dardiri, D.H. Ferris, J.A. House, S.P. Sahu, G.M. Schloer, S.H. Wool, R.J. Yedloutchnig

Monoclonal Antibody Research
J.A. House, G.J. Letchworth, D.O. Morgan

Foot-and-Mouth Disease Research
B. Baxt, J.H. Blackwell, C.H. Campbell, M.J. Grubman, C.A. House, R.C. Knudsen, P.D. McKercher, D.M. Moore, D.O. Morgan, J. Polatnick, B.H. Robertson, I.V. Wesley, S.H. Wool

Genetic Engineering
M.J. Grubman, P.D. McKercher, D.M. Moore, D.O. Morgan, B.H. Robertson

Arthropod-Borne Viruses
C.H. Campbell, W.R. Hess, G.J. Letchworth, J.S. Walker

African Swine Fever Disease Research
J.F. Edwards, G. Geering, W.R. Hess, R.C. Knudsen, G.J. Letchworth, J.W. McVicar, C.A. Mebus, I.C. Pan, G.M. Schloer, L.M. Swaney, R.D. Wesley

Virus and Vaccine Production
J.H. Blackwell, G.S. Hardy, C.A. House, P.D. McKercher, D.M. Moore, D.O. Morgan

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J.H. Blackwell, P.D. McKercher

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J.J. Callis, A.H. Dardiri, D.H. Ferris, C.A. Mebus, S.P. Sahu, G.M. Schloer, R.J. Yedloutschnig

Foreign and Extramural Programs
J.J. Callis, A.H. Dardiri, C.M. Groocock, F.M. Hamdy, G.M. Schloer, J.S. Walker

Safety Activities
F.I. DeCristofaro, J.Y. Richmond, R.R. Tornblom, J.S. Walker

Engineering and Plant Management
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Animal Supply Operations
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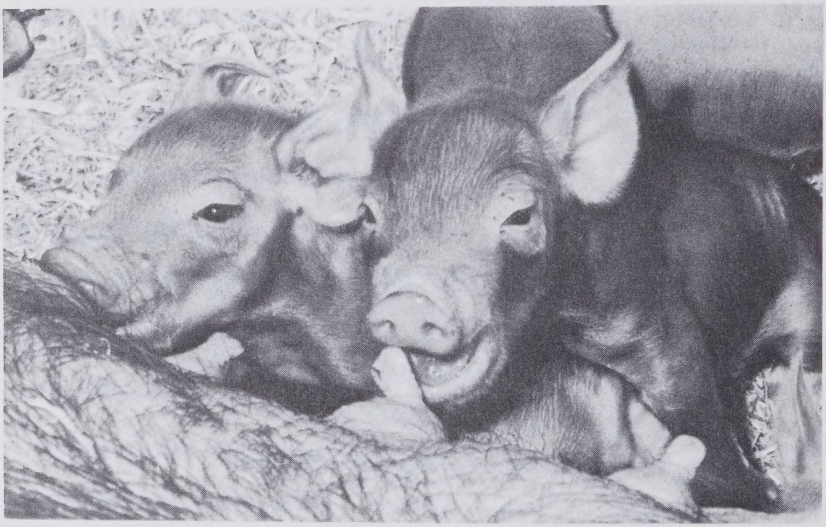
Support Activities
W.F. Harris, C.A. House, S.E. Perlman, P.M. Reynolds

The Plum Island Animal Disease Center

The Plum Island Animal Disease Center is a diagnostic and research facility devoted to preventing foreign diseases of animals from endangering the livestock population of the United States. The Center is part of the Agricultural Research Service of the U.S. Department of Agriculture (USDA). It is located on an island east of Long Island, N.Y., a site chosen to minimize the possible escape of foreign animal disease agents to the U.S. mainland.

Threats of outbreaks of foreign animal diseases in the United States, with potential risks that they might become established in the country, have increased in recent years as man and animals continue to move across international borders in ever-increasing numbers. Modern rapid transportation has increased the potential for the spread of diseases among countries.

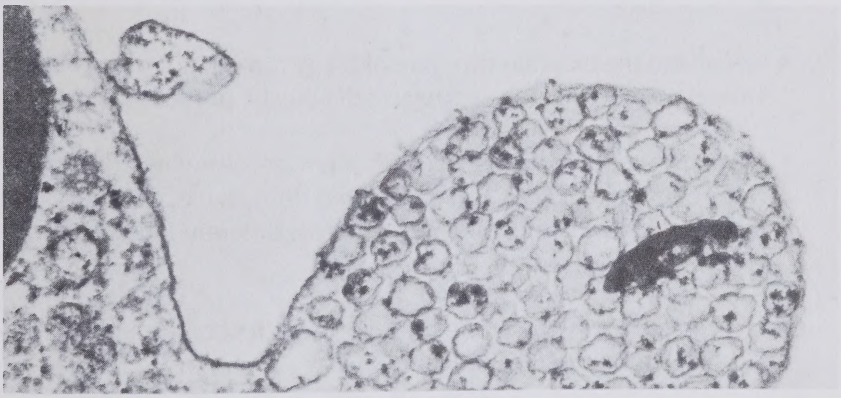


The fundamental mission of the PIADC is to help keep U.S. livestock, such as these baby pigs, free of foreign animal diseases. The Center is a national laboratory dedicated to solving international veterinary problems. Healthy animals used in the Center's diagnostic and research programs contribute ultimately to maintaining the health of animals throughout the United States and the rest of the world.

This scanning electron micrograph shows the erosive effect of foot-and-mouth disease virus three days after being injected into the tongue of a guinea pig.

The livestock population of the United States is susceptible to foreign diseases, such as foot-and-mouth disease and African swine fever. Diseases such as these must be guarded against with every available means, and the efforts of the Center are directed to keeping our livestock safe from the economic catastrophe that would result should an outbreak occur.

Thus, the Plum Island Animal Disease Center is responsible for (1) developing diagnostic capabilities for animal diseases that are foreign to the United States, (2) conducting a wide range of research endeavors on the causative agents of these diseases, and (3) developing procedures for the safe importation of animals and animal products.



A cell containing the rickettsia that causes a disease known as heartwater is shown in this transmission electron micrograph.

Accomplishments of PIADC Scientists

Diagnosis

- Studied the susceptibility of white-tailed deer and other animal species to various foreign animal diseases to determine the possible threat of these diseases to U.S. wildlife.

- Measured the immune response of American sheep and cattle to inactivated Rift Valley fever vaccine.

- Developed the hemadsorption reaction test and other sensitive tests for the diagnosis of African swine fever.

- Developed diagnostic procedures for approximately 40 foreign animal diseases.

- Isolated the virus causing duck plague and developed a vaccine that was adopted by the duck industry.

- Established the serological relationship between the orbiviruses causing Ibaraki and epizootic hemorrhagic fever diseases.

- Defined the serological relationship between swine vesicular disease virus and human Coxsackie B_5 virus, and found that the central nervous systems of pigs infected with either virus were similarly involved.

- Visualized the external structure of many foreign animal disease viruses by electron microscopy for diagnostic purposes.

- Demonstrated in cooperation with scientists elsewhere that new types of influenza virus can be isolated from swine, chickens, and turkeys infected simultaneously with two different influenza viruses.

- Diagnosed, for the first time, African swine fever in Brazil, the Dominican Republic, and Haiti.

- Developed a tissue culture plaque assay for FMD virus and its infectious RNA.

Molecular Biology of Foot-and-Mouth Disease Virus

- Demonstrated many physical and chemical properties of the virus necessary for understanding its biochemical nature.
- Determined the amino acid composition of virus proteins VP_1, VP_2, and VP_3 and demonstrated that the VP_3 capsid protein was immunogenic.
- Isolated a viral-specific double-stranded form of viral RNA.
- Demonstrated that capsid proteins are phosphorylated and that the virus contains a protein kinase.
- Isolated and characterized the RNA polymerase of the virus.
- Cloned VP_3 in *E. coli* K-12 and immunized livestock with the product.

Vaccines for Foot-and-Mouth Disease Virus

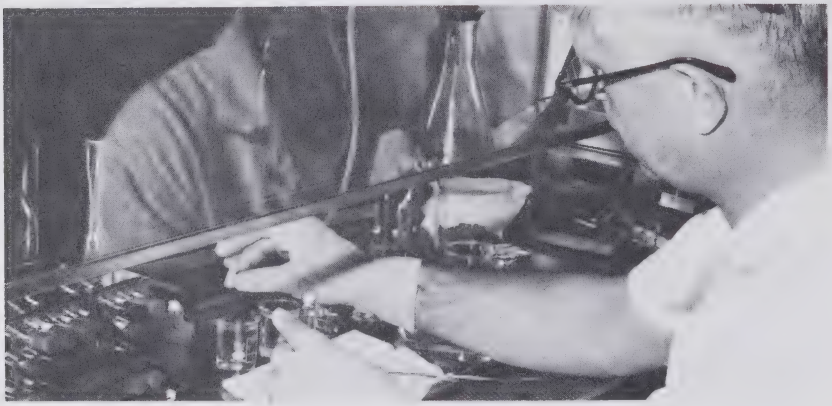
- Established a procedure for the production and purification of milligram amounts of virus from tissue culture cells, a technique necessary for biochemical and immunological studies.
- Developed methods for destroying the infectivity of the virus without destroying its immunogenicity so that whole virus vaccines can be produced.
- Developed an inactivated whole virus vaccine for cattle that was emulsified with oil adjuvant, and found that this vaccine was equally effective in swine.
- Developed a rapid method to concentrate the virus that permits the inactivated antigen to be stored for years in the gaseous phase of liquid nitrogen.

Transmission of Foot-and-Mouth Disease

- Found that the virus in bull semen could be responsible for the transmission of the disease.
- Followed the growth of the virus in the upper respiratory tract of nonimmunized, vaccinated, and recovered cattle after intranasal inoculation of virulent virus to determine how such animals might become reservoirs of infectious virus.

Diagnosis and Reagent Production

Diagnosis of foreign animal diseases, preparation of diagnostic reagents, and development of diagnostic tests are major functions of the Center.



Infectious disease agents are always handled in biological safety cabinets, which protect personnel from direct exposure to the disease agents.

Scientists have the responsibility to diagnose approximately 40 animal diseases foreign to the United States and to differentiate them from domestic animal diseases. Key emphasis is on foot-and-mouth disease and other vesicular diseases, such as swine vesicular disease, vesicular stomatitis, and vesicular exanthema of swine.

Examples of other exotic diseases diagnosed are:

Viral	— rinderpest, bluetongue, malignant catarrhal fever, African swine fever, African horsesickness
Mycoplasmal	— contagious bovine pleuropneumonia, contagious caprine pleuropneumonia, contagious agalactia
Rickettsial	— heartwater
Bacterial	— contagious equine metritis
Parasitic	— trypanosomiasis, East Coast fever

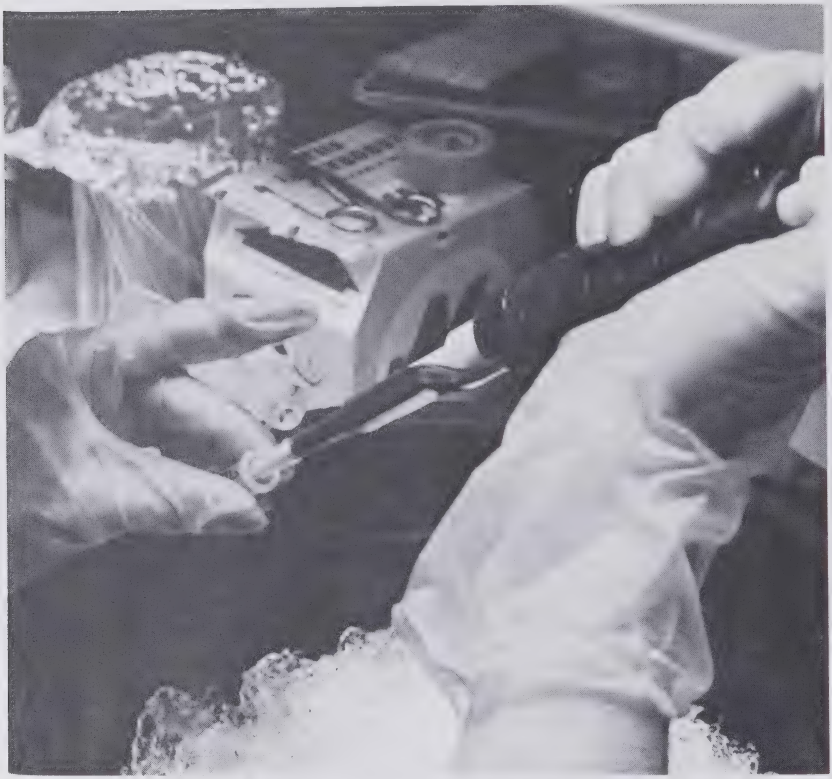
Samples are received at the Center from within the United States and throughout the world for diagnosis. Specimens from domestic livestock, zoological ruminants, and imported semen are tested for foreign animal disease agents.

The Center's research and diagnostic activities are supported by its electron microscopy unit. The scanning and electron microscopes allow scientists to visualizc cellular and viral structures. This is helpful in preliminary diagnostic studies, in locating micro-organisms within tissue cells, and in many other research activities.

Diagnostic reagents, such as antisera specific for foreign animal disease agents and inactivated antigens, are prepared for use at the Center and for distribution to other laboratories throughout the world. In 1979, in cooperation with the American Association of Veterinary Laboratory Diagnosticians and the Animal and Plant Health Inspection Service of the USDA, foreign animal diseases were listed in order of importance and estimates were made of the quantities of reagents needed to meet national emergencies. The reagents were produced at the Center and are now available when needed.

The development and improvement of rapid, sensitive diagnostic tests is an essential function because work in the United States with most exotic animal disease agents is restricted to the Center.

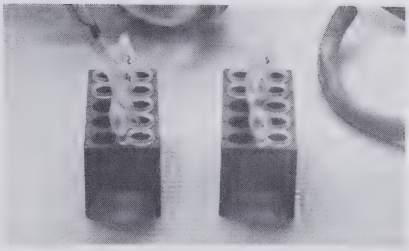
Monoclonal Antibody Research



Many biochemical studies require the use of radioactive isotopes to help scientists evaluate molecular interactions. The analysis of virus-cell interactions, antigen-antibody complexes, and other subcellular activities can be studied in this manner. Researchers who work with radioactive materials take precautions to protect themselves against accidental skin exposure by wearing gloves and using mechanical pipetting devices.

The study of viruses has progressed to the molecular level. Recombinant DNA techniques are being used to determine nucleotide sequences of the genes of viruses and bacteria and to divulge the structure of the proteins they encode. Recombinant DNA techniques, however, often cannot determine the function of viral and bacterial proteins or the relation of specific proteins to the immune response of the infected animal. This information is often best obtained using monoclonal antibodies.

Researchers at the Center are preparing monoclonal antibodies for use in the rapid diagnosis of foreign animal diseases and in many biochemical procedures.

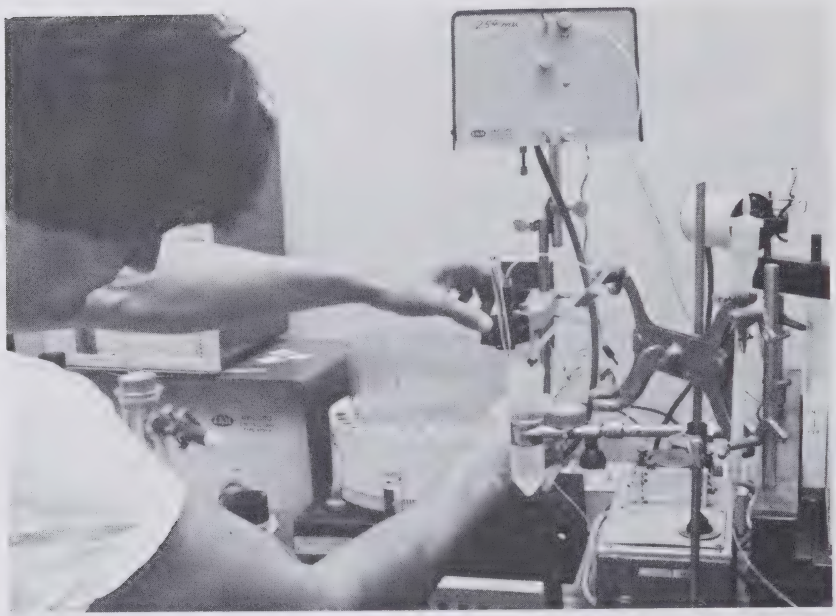


Monoclonal antibodies that have been produced in tissue culture systems can be evaluated in various ways. Often radioactive tracer methods are used by researchers to determine the specificity of the antibodies they have isolated.

Viruses and other disease agents contain many different molecular structures, or antigens, which stimulate an infected animal to produce antibodies directed against these different antigens. These antibody molecules, in turn, are capable of attaching to the antigens. It is extraordinarily difficult to isolate single antibodies from an animal, however, and specialized techniques have been developed to isolate single antibody secreting cells and grow them in tissue culture. Products of these cells are termed monoclonal antibodies and are characterized by being able to attach to only one specific part of one specific kind of molecule. A monoclonal antibody is, therefore, a probe that can locate and measure one specific molecule in a cell or animal that contains thousands of other kinds of molecules.

Only some antibodies produced by an animal in response to a viral infection are important in the animal's recovery from or protection against the disease. Studying a collection of monoclonal antibodies can determine which one is important in the animal's defense process. That antibody, in turn, becomes a unique probe in purifying the appropriate viral antigen to which it attaches. Recombinant DNA methods can then focus on production of that single viral protein for use as a vaccine. Monoclonal antibodies can also interfere with the function of the protein to which they bind and thus reveal which protein has that function and what happens when that function is specifically altered.

Thus, monoclonal antibodies are well suited for diagnostic use where they will find and identify viral and bacterial proteins among the thousands of normal proteins in diseased animals. They are also admirably suited for research where they will locate, identify, measure, and define the function of proteins.



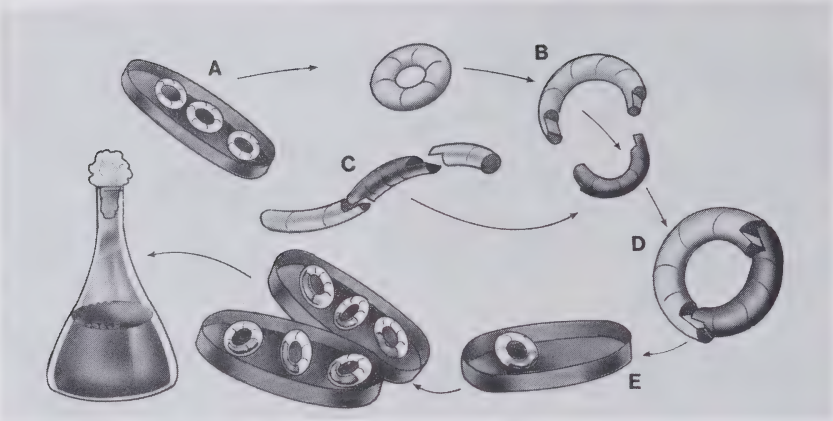
One biochemical procedure separates proteins on the basis of their specific binding properties to unique adsorbent.s. Solutions containing mixtures of proteins can be passed through columns containing these adsorbents. Subsequently, highly purified proteins can be isolated by selectively releasing the bound protein-adsorbent complexes.

Studies on foot-and-mouth disease are concerned with almost every aspect of the disease, ranging from laboratory research in molecular biology of the virus to field trials for evaluating vaccines and diagnostic procedures. Research on virus structure and function is providing information on antigenic sites, cellular receptors on the virion, and the mechanism of virus replication within host cells. Nucleic acid sequences for the ribonucleic acid (RNA) of the virus and amino acid sequences of the capsid and noncapsid proteins of viral serotypes are being determined. This information is being used to identify genetically conserved and variable areas in the nucleic acid sequences, amino acid sequences of antigenic sites, and cellular receptor sites. Studies of the replicative complex are providing insight on the interaction between viral-induced proteins and host cell components.

Extensive pathobiological research has been conducted to establish the importance of aerosol transmission of this disease. Immunological studies are concerned with identifying the humoral and cell-mediated immune mechanisms that protect the host against the disease. Inactivated or genetically engineered vaccines are evaluated, and methods of enhancing vaccine protection are studied.

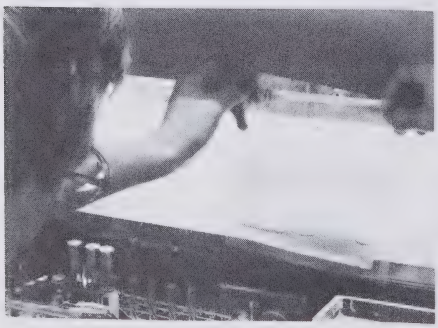
Basic research in the molecular biology of viruses has been part of the Center's activities for nearly 30 years. Scientists use sophisticated laboratory equipment and techniques to analyze nucleic acids and proteins, the major components of viruses.

The practical consequences of these studies are the development of more effective vaccines, diagnostic procedures, and strategies for control of foot-and-mouth disease.

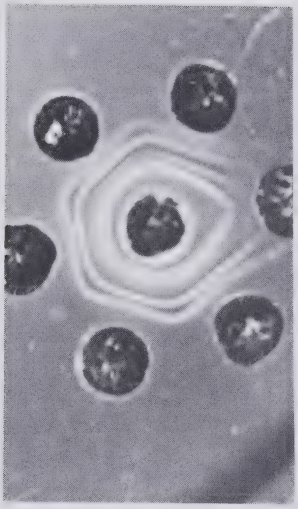


Small circular gene elements, called plasmids, are isolated from the common bacterium, E. coli (A). The circle is opened with a specific enzyme (B), and a copy of the gene for the FMDV vaccine protein is cut out and inserted into the plasmid (C). The plasmid is closed with another enzyme. The circular gene element is again functional and now contains a new gene—the FMDV vaccine protein gene (D). This recombinant plasmid is inserted into E. coli (E), which, when grown in culture media, produces large quantities of the vaccine antigen without the infectious virus itself being present.

The Center has been instrumental in the development of a cloned viral protein which is the basis for a vaccine for foot-and-mouth disease (FMD). Secretary of Agriculture John Block announced this 1981 achievement "as being the first production through gene splicing of an effective vaccine against any disease of animals or humans and that its



The proteins of purified viruses can be separated by high voltage electrophoresis in a semisolid matrix. The net electrical charge of the individual proteins causes them to move at different rates. A technician observes the separated protein bands after they have been stained.



Agar-gel precipitation techniques can be used to identify viral proteins using highly specific antibodies.

PIADC scientists were honored in 1982 for their work in developing a genetically engineered vaccine for foot-and-mouth disease. Howard Bachrach, holding a plaque presented by the Secretary of Agriculture, is surrounded by researchers Marvin Grubman, Douglas Moore, Betty Jo Robertson, Donald Morgan, and Peter McKercher.

use could mean a savings [worldwide] of billions of dollars and an increase in the world's supply of meat."

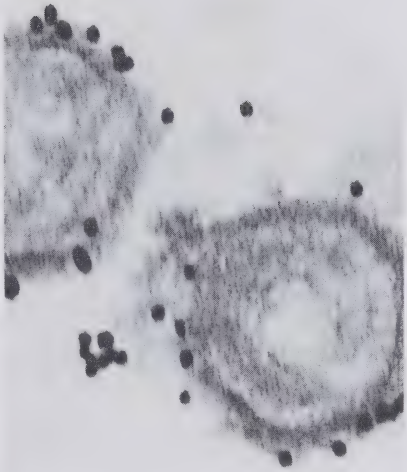
Plum Island scientists first demonstrated that a coat protein from FMD virus could be used to vaccinate livestock and identified amino acid sequences specifying this protein. Next, in collaboration with Genentech, Inc., scientists, they identified and transferred the appropriate gene from an FMD type A virus to a harmless strain of *E. coli,* causing it to produce protein that was as immunogenic in livestock as protein isolated from virus particles.

These first experiments with the prototype cloned protein vaccines were considered very successful. This new technology made it possible to genetically engineer the active proteins of the major field strains of the seven immunological types of FMD into *E. coli.* Adaptation of this technology to commercial production operations is quite easy.

Finally, the gene-splicing work has helped identify the amino acid sequences of the immunogenic sites and made possible direct chemical syntheses of the immunologically active peptides.

Arthropod-Borne Viruses

Soft ticks are known to transmit foreign animal diseases, including African swine fever. Scientists determine whether arthropods found in the United States can transmit these diseases.



The black dots in this electromicrograph of African swine fever virus resulted from an immunocolloidal gold labeling technique developed to enable scientists to visualize the specific antibody binding sites.

Many of the foreign animal diseases studied at the Center have an added dimension that greatly complicates their control and eventual eradication. They have arthropod vectors–ticks, mosquitoes, gnats–that transmit and, in some cases, maintain the causative agent in the field.

The potential vectors of these diseases among the arthropods present in the United States must be identified, and the interactions between the disease agent, the vector, and the livestock host must be understood. Studies of such interactions have shown, for example, that African swine fever virus can be maintained and transmitted by the native American ticks *Ornithodoros coriaceus* and *Ornithodoros turicata*. These studies must be conducted in biological containment facilities to prevent escape of the vectors as well as the disease agents and to protect personnel and experimental animals from accidental infection.

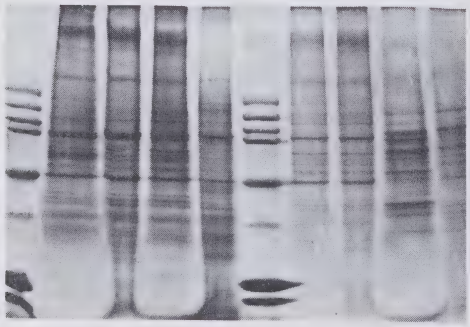
Ticks are raised in laboratories so that scientists can determine whether they can transmit foreign animal disease agents. Appropriate measures can then be developed to control the spread of a foreign arthropod-borne disease that might enter this country.

Arthropod-borne disease agents can be grown in the laboratory in tissue cell cultures or experimental animals, and many types of studies can be performed without use of the vector. Much of the research at the Center is directed to developing ways to diagnose these diseases in case they should enter the United States and, more importantly, to control their entry by preventing the importation of infected animals or products that may harbor the disease agents. Reagents and diagnostic tests have been developed for African swine fever, African horsesickness, Akabane disease, heartwater, ephemeral fever, exotic bluetongue disease, Rift Valley fever, and several other foreign arthropod-borne diseases.

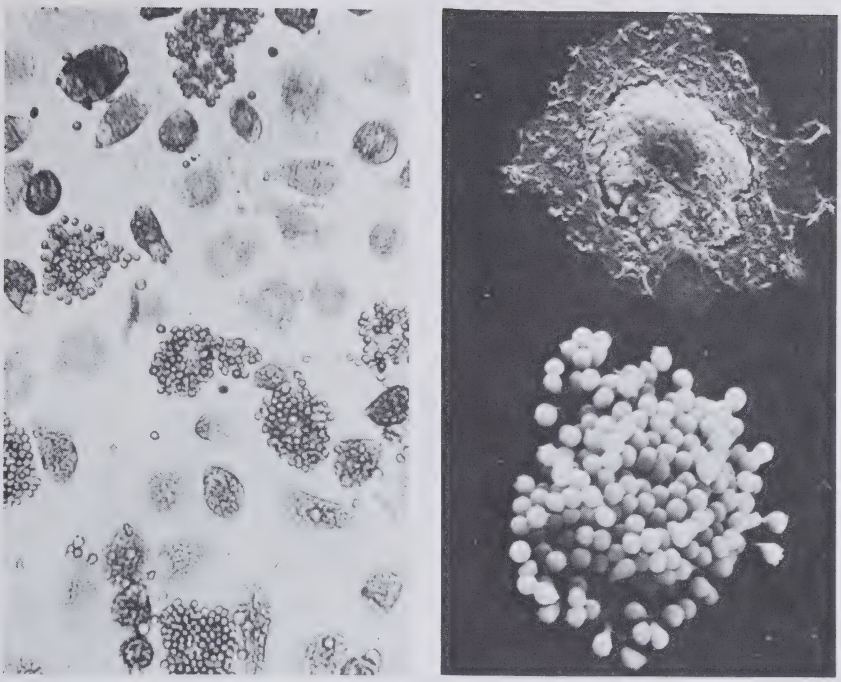
African Swine Fever Disease Research

Viruses are micro-organisms that can multiply only in living cells. Virus-induced cell destruction can often be identified in cell cultures hours after infection.

African swine fever (ASF) is an infectious disease affecting swine of all ages. Before 1958, ASF was found only in southern Africa, but then it spread to Spain and Portugal and occasionally to other countries. ASF first occurred in the Western Hemisphere in Cuba in 1971; it was eradicated but reoccurred in 1980. Brazil, the Dominican Republic, and Haiti reported ASF outbreaks in 1978.



This picture shows the proteins of African swine fever virus that have been separated by high voltage electrophoresis. Each column contains viruses obtained after different biochemical purification procedures.



These photographs illustrate the hemadsorption test for African swine fever virus. Red blood cells will only adsorb to the white blood cells that have been infected with the virus. Adsorption, or clumping, is seen in the photomicrograph on the left and in the scanning electron micrograph on the right.

ASF virus is the only member of the iridovirus family that infects mammals; the others infect fish, insects, amphibians, and plants. The virus can replicate and persist in soft ticks for many years. ASF virus induces an immune response, but circulating antibodies do not neutralize the virus. Vaccines are not yet available. Recovered pigs are persistently infected, and products produced from them are a proven source of infection for other pigs.

The broad spectrum of ASF research at the Center is designed to provide information useful in disease control. Researchers isolate and purify viral antigens for diagnostic and biochemical studies, characterize the genome by restriction endonuclease analysis, and produce monoclonal antibodies to detect antigenic determinants. They also study the pathogenesis of ASF infection in pigs, ticks, and other arthropods. The immunological response to different ASF viral isolates and the role of cell-mediated immunity are an integral part of this research.

The Plum Island Animal Disease Center

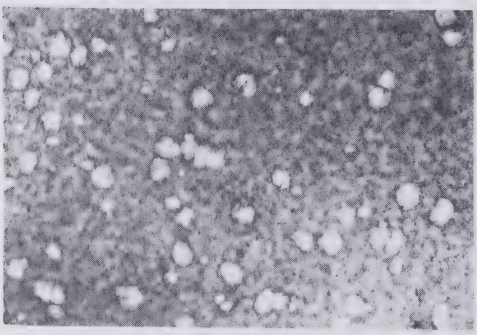
1. Lighthouse overlooking Long Island Sound and Plum Gut.
2. The PIADC Sewage treatment facility.
3. The research laboratory complex (Buildings 101, 102, 103).
4. Administrative buildings and support services.
5. Large Animal Supply and quarantine area.
6. The Diagnostic Laboratory (Building 257).
7. Plum Island harbor and warehouse complex.

Virus and Vaccine Production

Monolayers of tissue culture cells are grown in large roller bottles. The cells subsequently can be grown in other vessels as required by the scientists.

The Virus Production unit is a large-scale facility that supplies viruses grown in monolayer tissue culture cells to the Vaccine Development laboratory and to researchers. These products enable scientists to work with uniform preparations or purified virus for critical biochemical and genetic engineering research.

The Vaccine Development laboratory concentrates, inactivates, and stores foot-and-mouth disease virus antigens for future use in vaccines. When needed, these antigens can be thawed, diluted, mixed with adjuvants to create vaccines, and bottled within a few days.



As a virus multiplies, it destroys its host cells, eventually forming clear areas in the tissue culture monolayer.

Large quantities of viruses are needed for research and vaccine development. The viruses are first grown in large numbers of monolayer cell cultures, and the infectious supernatant fluids are collected the next day. Equipment in the Center's Vaccine Development laboratory is then used to purify and concentrate the viruses.

There are many different strains of foot-and-mouth disease viruses. The virus strain in an effective vaccine must closely match the virus strain causing the disease outbreak. Therefore, a variety of viral antigens are stockpiled at the Center so that vaccines can be custom formulated to protect animals against the major current field strain(s).

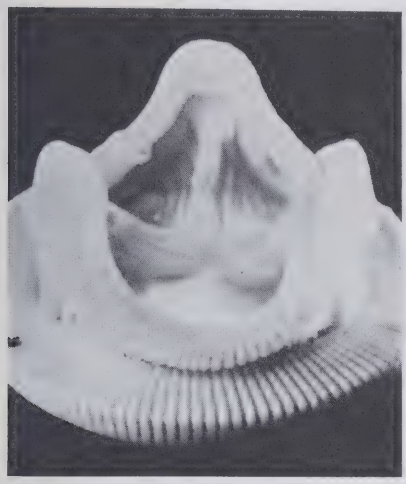
The Virus Production unit also evaluates the stability and potency of the antigens during long-term storage in liquid nitrogen freezers and develops new methods for vaccine production. Advances in technology are shared between the United States and other concerned countries in order to control the disease more effectively. There are special collaboration agreements between Mexico, Canada, and the United States.

Food and Product Evaluation

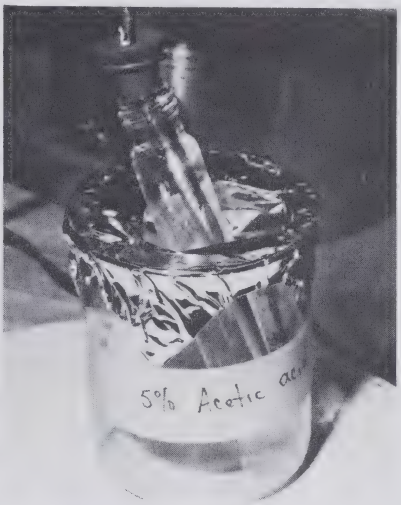
Scientists evaluate many methods for processing food and other products to determine whether potentially infectious contaminants are inactivated by these procedures. One technique is to evaluate the temperature required to destroy FMD virus in meat, as illustrated above.

Foreign animal diseases studied at the Center are infectious for livestock of economic importance to the United States. Studies have shown that some animal disease agents can survive in meat, milk or other products and can subsequently cause disease in animals that consume these materials. Knowledge of what diseases can be transmitted in this manner is important in controlling their possible introduction into this country.

Experimental decontamination procedures have been developed to determine the ability of chemicals or other treatments to destroy infectious agents. These procedures evaluate the interactions of many environmental factors such as temperature, humidity and sunlight.



This is a pig heart valve. Center scientists developed techniques to destroy disease agents that might be present in these valves without damaging them. Imported heart valves are needed in some human open-heart surgery.



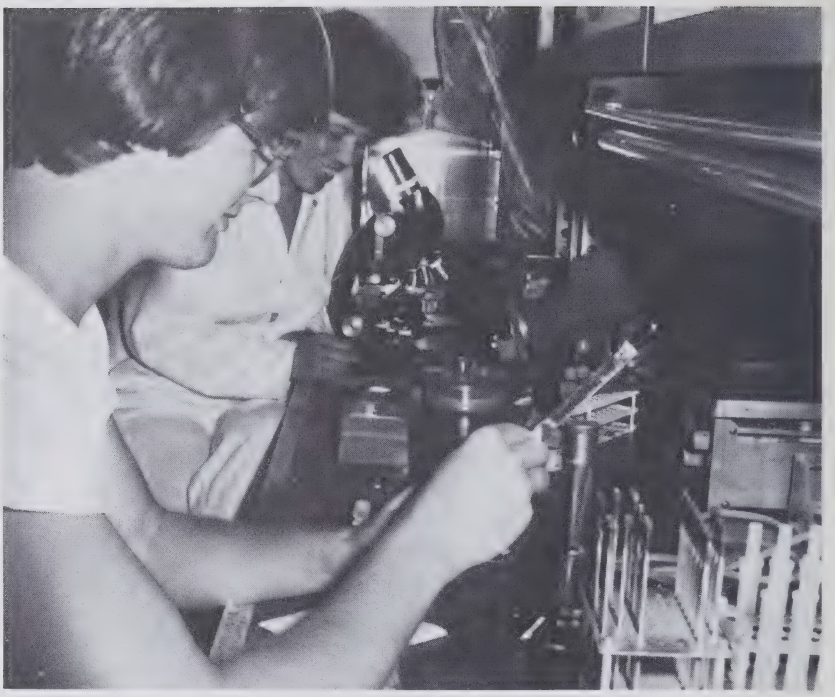
Center scientists evaluate various chemicals for their ability to inactivate foreign animal disease agents.

Methods whereby infected materials can be treated to inactivate infectious agents have been evaluated at the Center. In some instances, it has been necessary to reproduce commercial types of food processing systems in order to accurately and adequately assess whether the disease agents survive. In other instances, new techniques or processes have been developed to insure that the materials are free of foreign animal disease agents.

Results of such studies have contributed to the control or restriction of importation of these products from countries where these diseases exist.

Animal products that have been evaluated include hides and wool, cooked or smoked meats, milk and dairy products, intestinal casings, and materials used in the pharmaceutical industry. The technologies developed in these studies have been applied to similar studies, such as the survival of viruses in semen, embryos, and heart valves.

Training Programs



Opportunities exist for visiting scientists and graduate students to conduct research in the Center's high-containment laboratories on the agents that cause foreign animal diseases. Training films, manuals, and slide study sets are used and distributed worldwide.

Training is an integral part of the Center's mission and encompasses a wide scope of programs. One of the principal programs is a training course in the recognition of foreign diseases of cattle, sheep, goats, pigs, horses, and poultry. More than 500 veterinarians and scientists from the United States, Europe, Canada, Japan, Australia, and Central and South America were trained at the Center between 1974 and 1982.

The course gives Federal veterinarians engaged in emergency disease programs in the field as well as animal disease specialists from universities and foreign countries the opportunity to study the clinical signs and pathological changes caused by these diseases.

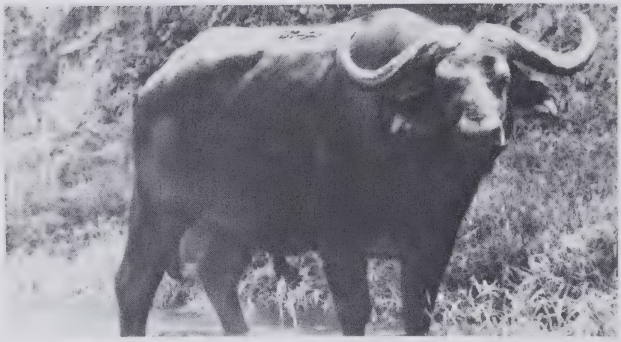
Lectures, laboratory demonstrations, and opportunities to observe animals infected with foreign animal disease agents are included in the training courses offered at the Center. Veterinarians, scientists, and laboratory technicians from the United States and foreign countries have gained first-hand knowledge in the recognition and diagnosis of these diseases.

Special courses have been given to field veterinarians in the recognition and control of new or rapidly spreading foreign animal diseases, such as contagious equine metritis after it appeared in Europe in 1977 and African swine fever after it entered three countries in the Western Hemisphere in 1978.

Senior veterinary students may elect to attend an internship training program at the Center to acquire experience diagnosing foreign animal diseases. University professors may spend 6 to 12 months on sabbatical leave to pursue research and gain first-hand experience in studying foreign animal diseases. Workers from State and university laboratories have been given practical training in the techniques of diagnosing these diseases.

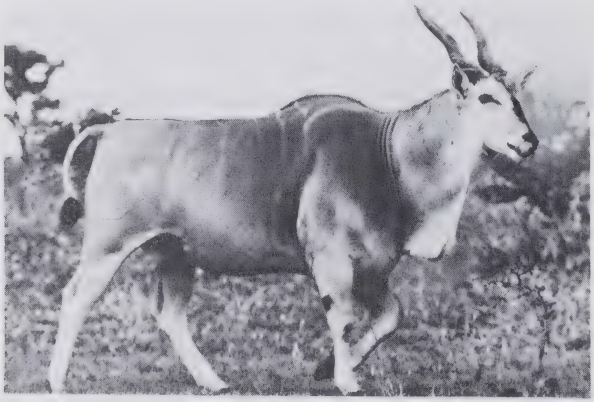
Opportunities exist at the Center for students from various colleges and universities to train under cooperative educational programs through an agreement between the Agricultural Research Service and the school. Students earn undergraduate credits while working at the Center for specified time periods.

Foreign and Extramural Programs



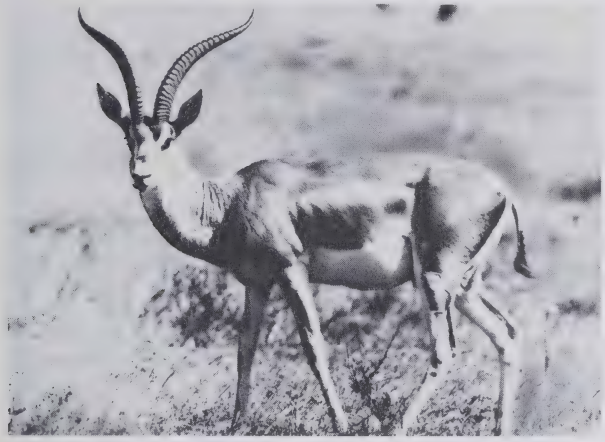
Diseases such as East Coast fever have been found in water buffaloes, and these animals are, therefore, carefully studied for their role in disease transmission.

Congress passed Public Law 480 in 1954, often referred to as the "Food for Peace" program. Its primary purposes are to expand foreign markets for U.S. agricultural products and to use U.S. agricultural abundance to combat hunger and encourage economic growth in the developing countries. The program makes U.S. agricultural commodities available at low cost, with long-term credit, or as donations for the emergency relief of such problems as famine. The recipient country agrees to undertake agricultural development projects to improve its own food production or distribution.



Antelope, deer, and other ruminants are species that are susceptible to many foreign disease agents. Scientists may study these diseases in remote areas of the world.

The Plum Island Animal Disease Center is cooperating in P.L. 480 projects in Pakistan and Egypt. Mycoplasma organisms affecting sheep and goats and a rinderpest-like disease of water buffalo are being studied in Pakistan. Egyptian scientists are performing research on velogenic viscerotropic Newcastle disease virus, African horsesickness, and Rift Valley fever.



Center scientists may travel to foreign countries to learn how wild animals, such as this gazelle, respond to diseases that may pose a threat to U.S. livestock. On other occasions, foreign scientists may come to the Center to conduct research projects.

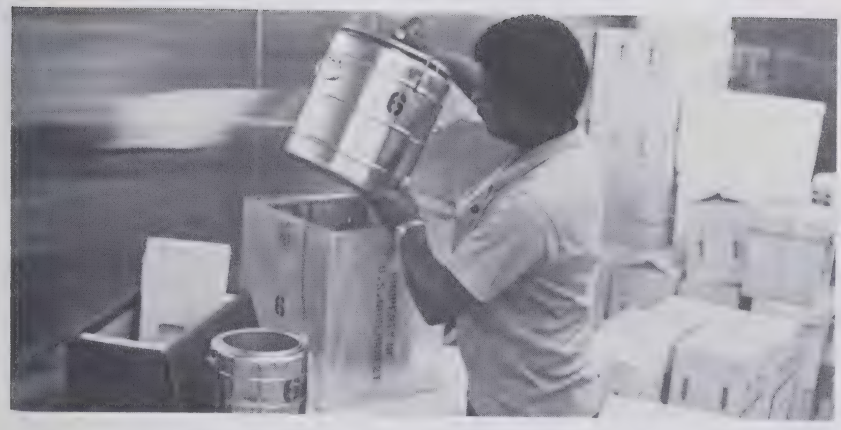
The Plum Island Animal Disease Center also participates in United States-Israel (Binational) Agricultural Research and Development Fund (BARD) projects. The governments of the United States and the State of Israel established BARD in 1977 to promote and support agricultural research for the mutual benefit of both countries. Cooperative research between the Center and Israeli scientists is currently supported for projects on velogenic viscerotropic Newcastle disease and Rift Valley fever.

Another research project of the Center is carried out at the Kenya Research Veterinary Laboratories in Muguga, East Africa. A Center scientist is part of an international team of investigators studying the antigenic structure of exotic hemoprotozoans that infect cattle and other animals. One such disease, East Coast fever, causes high mortality in cattle and is difficult to control because it is transmitted by ticks. The object of the research is to develop more accurate diagnostic methods and vaccines.

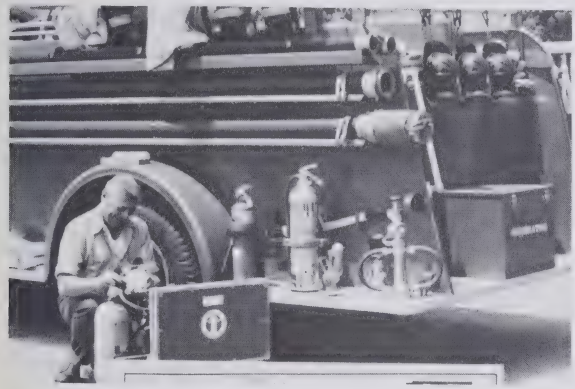
Safety Activities

Cattle and other large animals are delivered to a transfer point at the Center's ferry terminal at Orient Point, Long Island. The animals are moved from the vendor's truck to a Center truck and transported by government boat to Plum Island. The vendor's truck is thoroughly washed and decontaminated at Orient Point before it returns to the farm. On Plum Island, the animals are again transferred to another truck for delivery to the animal holding areas. These breaks in delivery are part of the Center's biological safety procedures designed to minimize the possible inadvertent spread of disease agents to the mainland.

The activities of the Safety Office at the PIADC support diagnostic, research, and service programs as performed in high-containment laboratories. These specialized laboratories require constant monitoring and attention to insure that all biocontainment systems are properly maintained, a responsibility jointly shared between Safety and Engineering and Plant Management employees. Air handling systems, autoclaves, biological safety cabinets, and other equipment are monitored by these personnel to maintain constant integrity of all primary and secondary biocontainment barriers. Containment of infectious micro-organisms insures that personnel, animals, reagents, and the environment are safe from accidental contamination.



Biological reagents require secure packaging to prevent their degradation during shipment.



Personnel in the Center's Fire Department are on the island at all times to respond to fires and to administer emergency first aid.

The Safety Office provides regulations, instructions, and training for employees in biological, chemical, radiological, and industrial safety. Safety personnel develop new methods to decontaminate infectious agents, evaluate new mechanical or personal protective devices, and assist researchers in developing safe ways to conduct experiments.

All employees can participate in a voluntary medical surveillance program, which includes health maintenance opportunities. It monitors the health of employees who might be exposed to toxic substances or infectious microorganisms. This program is an integral part of the safety operations, as are fire protection, security operations and transportation of infectious materials inside and outside the laboratories.

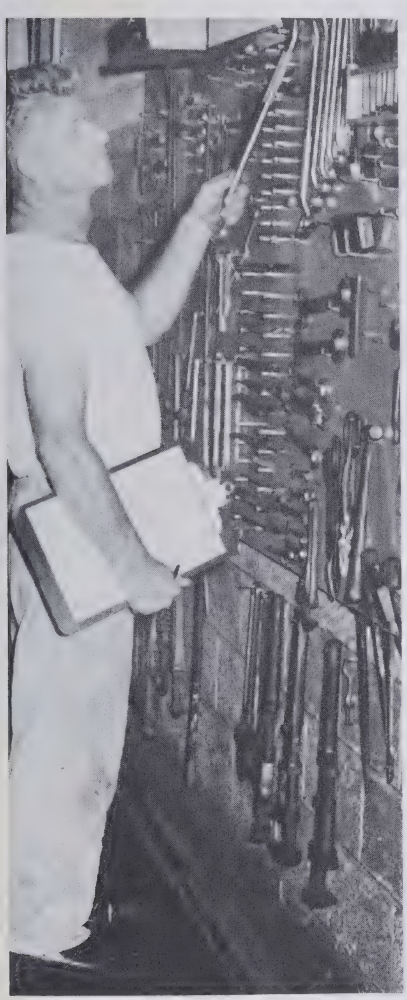
Engineering and Plant Management

Precision welding is one of the specialized skills required to maintain the laboratories. Many other skilled craftsmen work inside and outside the laboratories to support the Center's diverse maintenance, design and construction needs.

The Engineering and Plant Management (E&PM) staff provides services equivalent to those required by a small city. They operate a ferry service 16 hours a day, provide a potable water supply, treat the sewage, can provide 100 percent of the required electricity, operate the buses and maintain the Center's buildings, grounds, and a variety of vehicles.

Operating the Center's two high-containment laboratories is, perhaps, the most important E&PM activity. The air handling systems of these laboratories require special attention. Negative air pressure gradients constitute the principal internal biological containment barriers; filtered exhaust air return to the environment assures that infectious disease agents stay inside the laboratory buildings. Planning for improved design changes to meet ever-changing research needs, developing energy-conservation measures, and modifying physical facilities to meet the demands of biological and industrial safety are constant challenges to the E&PM staff.

The new waste-water treatment plant received a national design award for engineering excellence in 1982 from the American Engineering Consulting Council of Washington, D.C. The water in the tertiary treatment lagoon is reported to be so clean that its biggest source of pollution is from the geese and ducks that swim in it.



E&PM personnel have shops in both laboratory buildings so that various maintenance jobs can be done quickly and efficiently. Technical and mechanical competence is required to troubleshoot the systems that control and regulate the laboratories' air handling equipment, sophisticated instrumentation, and other systems needed to assure building biocontainment.

Well-equipped workshops inside each laboratory building provide skilled E&PM craftsmen with the equipment needed to fabricate parts required for emergency repairs and to construct unusual equipment for research activities.

Animal Supply Operations

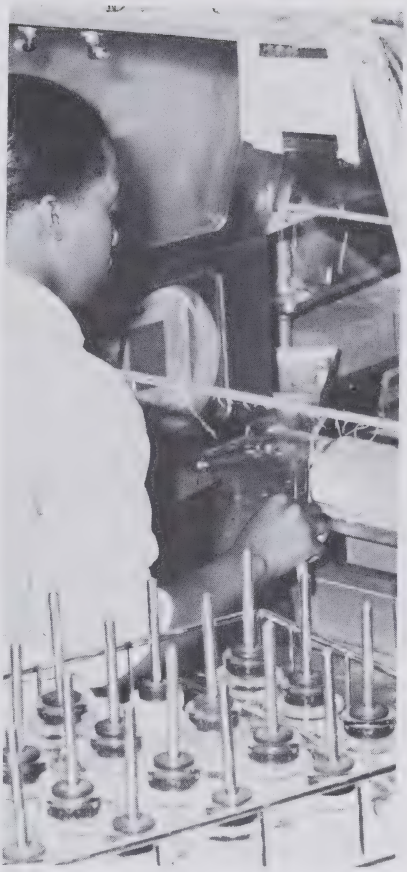
These cattle have just been delivered from a farm to Animal Supply and will be kept in isolated quarantine until they are needed in the laboratories.

Laboratory animals are at the core of the diagnostic and research efforts of the Center. Cattle, swine, sheep, goats, horses, and mice are the most frequently used species. Others include guinea pigs, chickens, gerbils, and hamsters.

The health of the animals is of primary importance. Only suppliers who adhere to strict health and husbandry practices are under contract to supply cattle, swine, or guinea pigs to the Center. These animals are produced under rigid contractual specifications. Government veterinarians periodically inspect the premises of the suppliers to see that high standards of quality and management are maintained.

Animal Supply is also responsible for providing fertile eggs, tissues, organs, and blood products to Center scientists. Occasionally it produces gnotobiotic or colostrum-deprived animals for the laboratories.

Animals quarantined in Animal Supply are treated with sprays to keep them free of ticks and other biting insects. Efficient husbandry practices are used to assure that the animals are maintained in excellent health.



Among the many different animals needed at the Center, mice require considerably more attention and care than larger animals. Fresh water, feed, and bedding must be provided daily for the thousands of cages of mice needed each month.

The Center's mouse colony is one of the oldest in continuous operation in the United States. This closed (no animals added) colony was originated in the early 1950's with mice from the Rockefeller Institute in New York and is genetically defined. Environmental and nutritional conditions are strictly controlled. Emergency air handling systems are available. Only authorized personnel are permitted in the colony, and they must shower and don special clothing before entering. These strict procedures are taken because loss of the colony would require many years to replace the genetic background and disease response data currently available.

Support Activities

Manuscripts, reports, correspondence, and other written materials are typed in the Center's Word Processing unit. Information can be dictated by telephone from all island locations or can be submitted as written copy.

Modern diagnostic and research activities require many specialized support services to function efficiently. When these activities are conducted in high-containment laboratories, the level of effort required is extremely high. Several units support the Center's activities in a coordinated though independent manner.

Researchers and diagnosticians require large quantities of diverse tissue culture cells, prepared for established cell culture lines as well as from a variety of animal tissues. The Research Services unit produces these cells for all the laboratories, along with quality-tested tissue culture media, other cell reagents, and clean glassware.

The Center's library, located in the Administration Building, is open 24 hours a day. It has an extensive collection of literature concerning animal diseases foreign to the United States, in addition to serials and textbooks pertinent to the research of the Center. Electronic information retrieval systems (DIALOG, OCLC, EMERPRO) are available for computerized literature searches.

The Center's library includes a large collection of reference material on veterinary medicine, microbiology, biochemistry and related fields.

The thousands of different items needed for the diversified activities associated with operating an island-based laboratory are stored in the Plum Island warehouse.

Photographs, graphs, and other illustrations for technical publications and poster displays are prepared by the staff of Audiovisual Services. The staff produces slides, video tapes, and movies for technical presentations. They design and prepare a variety of illustrations for in-house use and assist investigators in recording diagnostic or research results.

A centralized computer center became operational in February of 1982. It is a multiuser system with terminals and printers in various laboratories and administrative offices. The Center's staff is further supported by a centralized Word Processing unit responsible for preparing technical manuscripts, training materials, correspondence and various documents.

The Management Services staff is responsible for warehousing, inventory control, laundry, cafeteria services, fiscal control, and miscellaneous support activities necessary for maintaining a cohesive and efficient Center.

PIADC History

Plum Island is located 110 miles east of New York City, about 10 miles from Connecticut, and about 1.5 nautical miles off the northeastern end of Long Island, N.Y. The island is slightly more than 840 acres (1.3 square miles); it is 2.9 miles long and is 1.7 miles wide at its western end.

Plum Island was anciently known as the "Isle of Patmos." Later, explorers observed many beach plums growing along its shores and a new name, Plum Island, was subsequently accepted. The island was occupied by the Corchug tribe of Indians, who owed allegiance to the Montauk tribe and who recognized Wyandanch, Sachem of the Montauk tribe, as the Grand Sachem of Paumanake, or Long Island. The first written deed read:

> *"Know all men by these presents that I, Wyandanch, the Montauket Sachem, for me and my heirs forever, for and in consideration of a coat, a barrel of biskitt, 100 muxes*[1] *or fish hooks, at these subscribing by mee, received of Samuel Wyllys of Hartford, doe sell, alienate and make over all my right, title and interest unto Plumbe Island to the said Samuel Wyllys and his heirs forever: I, the said Sachem, hereby declare myself to bee the rightful owner of the sayd Island and I covenant with the said Samuel Wyllys, his heirs and assigns, that I will never molest him or his assigns in the possession of same and will prohibit my men from doing so, by killing any of his cattle that shall bee put upon it. And for the true performance hereof, I have set my hand at Gadiner's Island, April 27, 1659."*

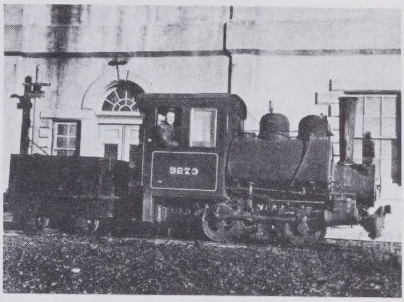
(Signed) *Wyandanch*
His X Mark

[1]Muxes were iron drills the Indians used to make wampum beads from different shells.

The early settlers of Plum Island were farmers. They shared the island with the Coast Guard and coastal watch contingent.

The lighthouse, located on the westerly end of Plum Island, was built in 1869 and is the third to be erected on this site.

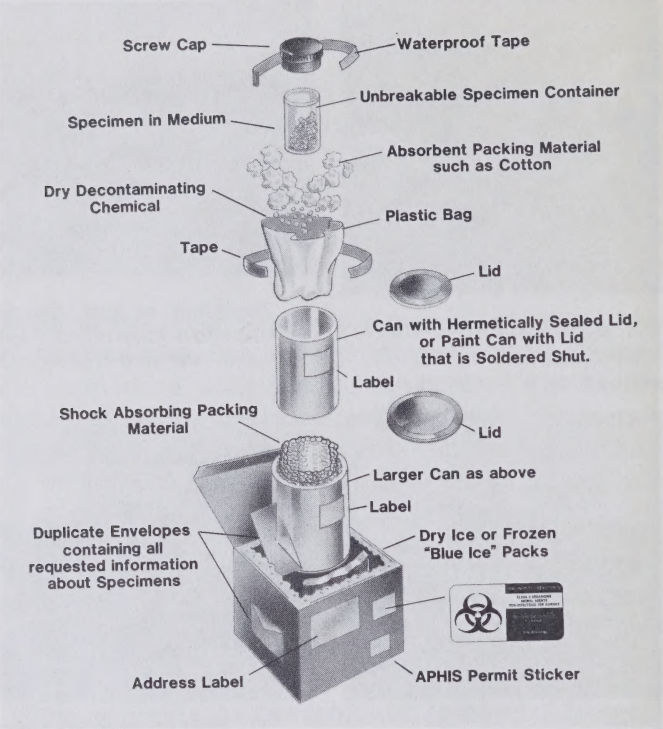
Plum Island was considered important to the defense of Long Island Sound during the Spanish-American War.



The Plum Island railroad, built by the Army during WW II to move submarine mines to and from boats, no longer exists.

For two centuries, Plum Island was owned privately and used for farming and raising sheep. Along with the other nearby East End islands, Plum Island was often a stopping place for the tall ships that sailed along the Atlantic coast and eventually became part of the observation system established to protect Long Island Sound and the harbor of New York. The U.S. Government bought the island in the 1890's and established Fort Terry, a coast artillery post. It was used as a training camp for young recruits in WW I and WW II. The island was assigned to the Army Chemical Corps after WW II. On July 1, 1954, Plum Island was formally transferred to the U.S. Department of Agriculture to establish a laboratory to study foot-and-mouth disease and other exotic diseases of economically important domestic animals. A new, high-containment laboratory was opened in 1956. Since then, diagnostic, research, and training programs at the Plum Island Animal Disease Center have been extended to cover many foreign animal diseases.

Packaging Infectious Biologicals



Samples collected for diagnostic evaluation or other materials known to contain infectious micro-organisms must be appropriately packaged. The external surface of the sealed primary container should be rinsed with a suitable decontaminant before canning to minimize the chance for cross-contamination. When appropriate, materials should be frozen before packaging. The preferred method of submitting samples to the Plum Island Animal Disease Center is to hand-carry them. If this is not possible, arrangements should be made to ship via nonstop (or at least same plane) service to New York. Please contact the Director, PIADC, before shipping; it may be necessary to obtain appropriate APHIS permits.

Packages should be addressed to:

Director, PIADC
P.O. Box 848, Greenport, NY 11944 1298
Cargo Building 80, JFK International Airport
Jamaica, NY 11430
HOLD FOR PICKUP BY PIADC DRIVER

Index

	Page
African horsesickness	8,17,29
African swine fever	5-6,8,16-19,27
Akabane disease	17
Bluetongue	8,17
Contagious agalactia	8
Contagious bovine pleuropneumonia	8
Contagious caprine pleuropneumonia	8
Contagious equine metritis	8,27
Diagnosis	6,8
Duck plague	6
East Coast fever	8,28-29
Ephemeral fever	17
Epizootic hemorrhagic fever	6
Foot-and-mouth disease	5-8,12-15,22-23,39
Genetic engineering	14
Heartwater	5,8,17
Ibaraki disease	6
Malignant catarrhal fever	8
Mission of PIADC	4-5,26
Newcastle disease	29
Rift Valley fever	6,17,29
Rinderpest	8,29
Semen	7,9,25
Shipping biologicals	40
Swine vesicular disease	6,8
Ticks	16,19,29
Training	26-27
Transmission of virus	7,13,16
Trypanosomiasis	8
Vaccines	7,11-15,19,22-23,29
Vesicular exanthema	8
Vesicular stomatitis	8